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# The Chemical Cluster in the Northeast Ohio Region

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*A Briefing Paper*

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# Purpose of Briefing Paper

The objective of this paper is to provide an overview of the chemical cluster in the Northeast Ohio (NEO) region. The term "cluster" refers to a geographic concentration of interdependent companies, suppliers, talent, and institutions that together constitute an important competitive advantage for the region. The paper is a starting point for discussion about the priorities of the chemical cluster—what needs to happen for the cluster to prosper in the future. The paper will be used as part of the process in which business leaders, public officials, and community leaders will have the opportunity to take action on top cluster priorities.

This briefing paper is a product of the Regional Economic Development Strategy Initiative. The Greater Cleveland Growth Association, in cooperation with the Akron Regional Development Board, Cleveland Tomorrow, and other Northeast Ohio regional leaders are directing the Project. The Gund and Cleveland Foundations have provided funding.

## Overview

This briefing paper describes the NEO's chemical cluster, elaborates on its growth potential, and explores possibilities for collaborative action.

In the first section, the paper describes the cluster's size in terms of employment and payroll, as well as the cluster's occupations, relative productivity, and exports. It also describes the intra-cluster relationships, including chemical products, suppliers, distribution channels, final markets, and the community infrastructure that supports the cluster.

The next section describes the potential of the chemical cluster, including external and internal influences, and the requirements for continued vitality of the Insurance cluster in NEO. The last section presents opportunities and ideas for possible collaboration among NEO's chemical companies, universities, and others.

# I. Cluster Description

The chemical cluster in Northeast Ohio is comprised of more than 360 companies in eight core industries. These companies are engaged in the manufacture of a variety of products including: industrial chemicals, paints and coatings, rubber products, and soaps. The cluster can be more easily understood in terms of these four groups of industries. Across industries, firms have a common thread – chemicals are used as inputs at some point in the production process. Among firms within a given industry, most specialize in select product lines that may allow them to face a narrow range of competitors. The use of this four-group division allows for the identification of trends within groups of industries that affect the cluster as a whole.

The cluster is comprised of companies operating in the following three-digit SIC categories listed by the industry groupings:

**Industrial Chemicals**
- SIC 147, Chemical and Fertilizer Minerals
- SIC 281, Industrial Chemicals
  Includes printing inks and chemical preparations
- SIC 289, Miscellaneous Chemical Products
- SIC 329, Miscellaneous Nonmetallic Mineral Products
  Includes abrasives and refractories

**Paints and Coatings**
- SIC 285, Paints and Allied Products

**Rubber Products**
- SIC 301, Tires and Inner Tubes
- SIC 306, Fabricated Rubber Products, N.E.C.

**Soaps**
- SIC 284, Soap, Cleaners, and Toilet Products

These industries manufacture a number a variety of products, some of which are used as inputs in the production processes of other manufacturers, while others are sold directly to individual consumers or industrial end-users.

## Characteristics

### Size and Growth

The chemical cluster provided nearly 32,000 jobs for Northeast Ohio in 1995. Table 1 displays detailed breakdowns by SIC. The cluster lost more than 4,500 jobs, or 12 percent of its employment, between 1989 and 1995. This decline was mostly due to the loss of employment in the tire industry, which

accounted for 95 percent of the net loss in employment. The tire industry suffered the largest loss of any core industry in both net employment and absolute terms, losing 4,200jobs for a decrease of 37 percent. Miscellaneous chemical products lost 1,700 jobs for a decrease of 25 percent. The largest employment gains were posted in the industrial chemicals and soap industries where employment increased 62 percent and 31 percent, respectively. Both industries experienced net gains in employment of more than 1,000 jobs.

The 12.2 percent decrease in employment in the chemical cluster contrasts sharply with the 6.2 percent growth rate for the region as a whole. The cluster saw its share of regional employment drop from three percent to 2.3 percent. The NEO region's share of employment in the chemical cluster industries also declined, this time from four percent to 3.7 percent.

The chemical cluster is highly concentrated in NEO, with a location quotient of 3.1. Every industry in the cluster is more highly concentrated in the region than in the nation as a whole. The location quotients in the cluster range from a low of 1.7 for miscellaneous nonmetallic mineral products to a high of 7.5 for the tire industry.

Table 1

| SIC | Description | Employment 1995 | Location Quotient * | Employment % Change 1989-95 | Employment Change 1989-95 |
|---|---|---|---|---|---|
| | CLUSTER CORE TOTAL | 31,851 | 3.1 | -12.2% | -4,425 |
| 147 | Chemical and Fertilizer Minerals | 494 | 3.0 | 18.5% | 77 |
| 281 | Industrial Chemicals | 5,642 | 1.8 | 30.5% | 1,320 |
| 284 | Soap, Cleaners and Toilet Goods | 3,485 | 1.9 | 61.6% | 1,328 |
| 285 | Paints and Allied Products | 2,566 | 3.8 | -11.9% | -346 |
| 289 | Miscellaneous Chemical Products | 5,116 | 4.5 | -25.0% | -1,704 |
| 301 | Tires and Inner Tubes | 7,209 | 7.5 | -37.0% | -4,225 |
| 306 | Fabricated Rubber Products, N.E.C | 5,721 | 4.3 | -16.6% | -1,136 |
| 329 | Miscellaneous Nonmetallic Mineral Products | 1,618 | 1.7 | 19.2% | 261 |

*Location quotient is the relative concentration of industry employment in the region compared to the nation as a whole (nation = 1.0).

Source: Ohio Bureau of Employment Services, Covered Employment and Payroll Data (ES202 Data), Edited by Cleveland State University's Urban Center.

## Payroll Per Employee

The chemical cluster provides high wage jobs that pay well above the average for manufacturing workers (see Table 2). Average payroll per employee in the cluster was $44,100 in 1995 compared, to $30,900 in all manufacturing industries. While the lowest payroll per employee was $28,400 in the fabricated rubber industry, the tire industry had the highest payroll per employee at over $61,800.

Payroll per employee in the cluster increased 2.1 percent in real (inflation adjusted) terms between 1989 and 1995. Six industries experienced increases, while two industries declined. Changes ranged from a decrease of

–9.3 percent in miscellaneous chemicals to an increase of 19.9 percent in industrial chemicals.

The regional payroll per employee in the cluster matches that of the nation as a whole. Relative to the nation, payroll per employee in the cluster is the same (index=1.00). Six of the eight industries in the region are within 10 percent of the national average earnings. Only NEO's soap and tire industries differ significantly from the national payroll averages, at 72 percent and 136 percent of national average earnings, respectively.

Table 2

| SIC | Description | Payroll Per Employee 1995 | Payroll Per Employee* % Change 1989-95 | Payroll Per Employee Relative to the Nation 1995 |
|---|---|---|---|---|
| | CLUSTER CORE TOTAL | $44,102 | 2.1% | 1.00 |
| 147 | Chemical and Fertilizer Minerals | $44,059 | 1.7% | 0.98 |
| 281 | Industrial Chemicals | $51,373 | 19.9% | 0.95 |
| 284 | Soap, Cleaners and Toilet Goods | $31,040 | -5.5% | 0.72 |
| 285 | Paints and Allied Products | $42,517 | 4.5% | 1.09 |
| 289 | Miscellaneous Chemical Products | $40,416 | -9.3% | 0.93 |
| 301 | Tires and Inner Tubes | $61,860 | 12.0% | 1.36 |
| 306 | Fabricated Rubber Products, N.E.C | $28,403 | 2.0% | 0.99 |
| 329 | Miscellaneous Nonmetallic Mineral Products | $37,446 | 5.9% | 1.04 |

*Payroll per employee figures from 1989 have been adjusted for inflation.

Source: Ohio Bureau of Employment Services, Covered Employment and Payroll Data (ES202 Data), Edited by Cleveland State University's Urban Center.

## Productivity and Export Strength

Productivity in the NEO chemical cluster exceeds that of the region as a whole by 41 percent. Table 3 identifies the cluster's relative productivity index of 1.41. Seven of the

core industries in the cluster are more productive than the average of all industries in the region. Only the fabricated rubber industry is less productive than the regional average, with an index of .94.

The cluster exports 64 percent of its products outside the region. The eight core industries of the chemical cluster account for a full 8.9 percent of NEO's total exports.

Table 3

| SIC | Description | Productivity * Relative to the Region 1992 | Percent of Output Exported Outside of the Region 1992 | Percent of Total Region's Exports 1992 |
|---|---|---|---|---|
| | **CLUSTER CORE TOTAL** | **1.41** | **63%** | **8.9%** |
| 147 | Chemical and Fertilizer Minerals | 1.89 | 82% | 0.1% |
| 281 | Industrial Chemicals | 1.68 | 37% | 1.6% |
| 284 | Soap, Cleaners and Toilet Goods | 1.04 | 70% | 1.6% |
| 285 | Paints and Allied Products | 1.35 | 85% | 2.1% |
| 289 | Miscellaneous Chemical Products | 1.37 | 75% | 2.0% |
| 301 | Tires and Inner Tubes | 1.77 | 20% | 0.1% |
| 306 | Fabricated Rubber Products, N.E.C | .94 | 81% | 1.2% |
| 329 | Miscellaneous Nonmetallic Mineral Products | 1.33 | 58% | 0.4% |

*Proxy for productivity based on gross metropolitan product per employee.

Source: Cleveland State University's Urban Center.

## Firm Size

In the chemical cluster the majority of the firms are small, while the majority of employment is at larger establishments. (See table 4) Firms with fewer than 100 employees make up 81 percent of the firms in the cluster, while establishments with 100

or more employees account for 76 percent of cluster employment. The average firm in the cluster has 89 employees.

Table 4

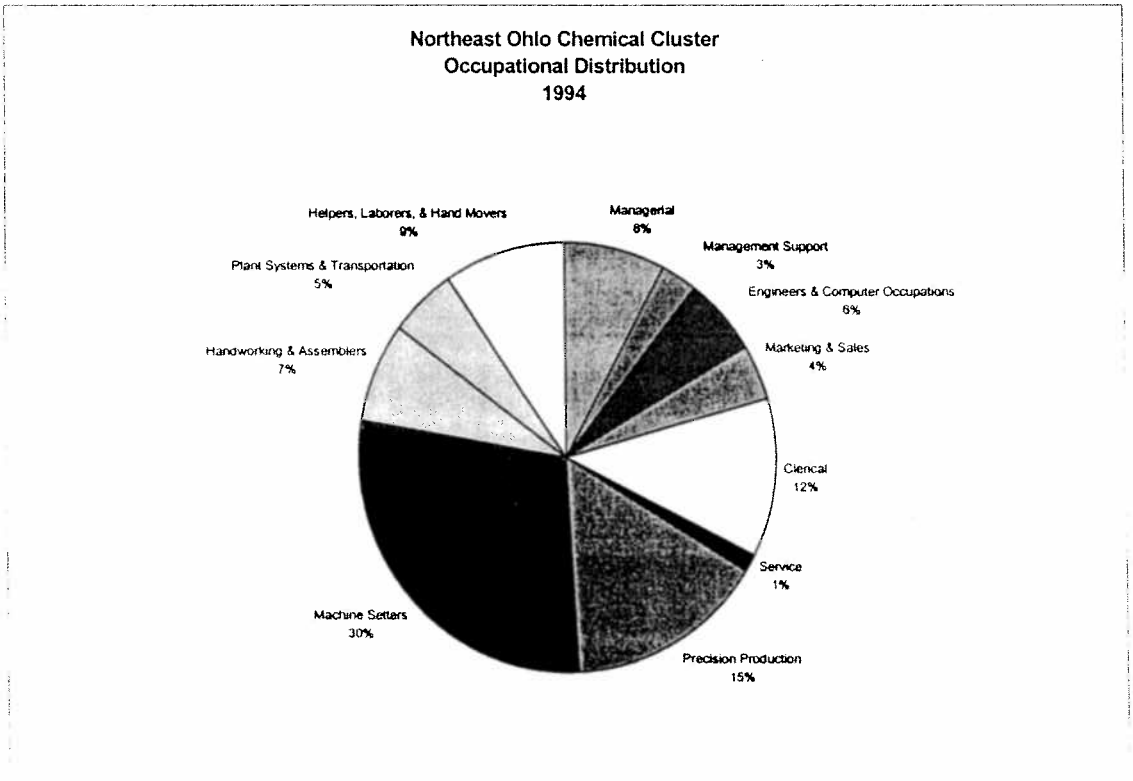
| Firm Size | % of Core Cluster Firms | % of Core Cluster Employment | Average Firm Size |
|---|---|---|---|
| 1-24 | 50% | 6% | 10 |
| 25-99 | 31% | 18% | 52 |
| 100-499 | 16% | 35% | 195 |
| 500+ | 3% | 41% | 1,297 |

Source: Ohio Bureau of Employment Services, Covered Employment and Payroll Data (ES202 Data), Edited by Cleveland State University's Urban Center.

## Occupational Distribution

Figure 1 shows the occupational distribution for the industries in the chemical cluster in 1994.

Figure 1



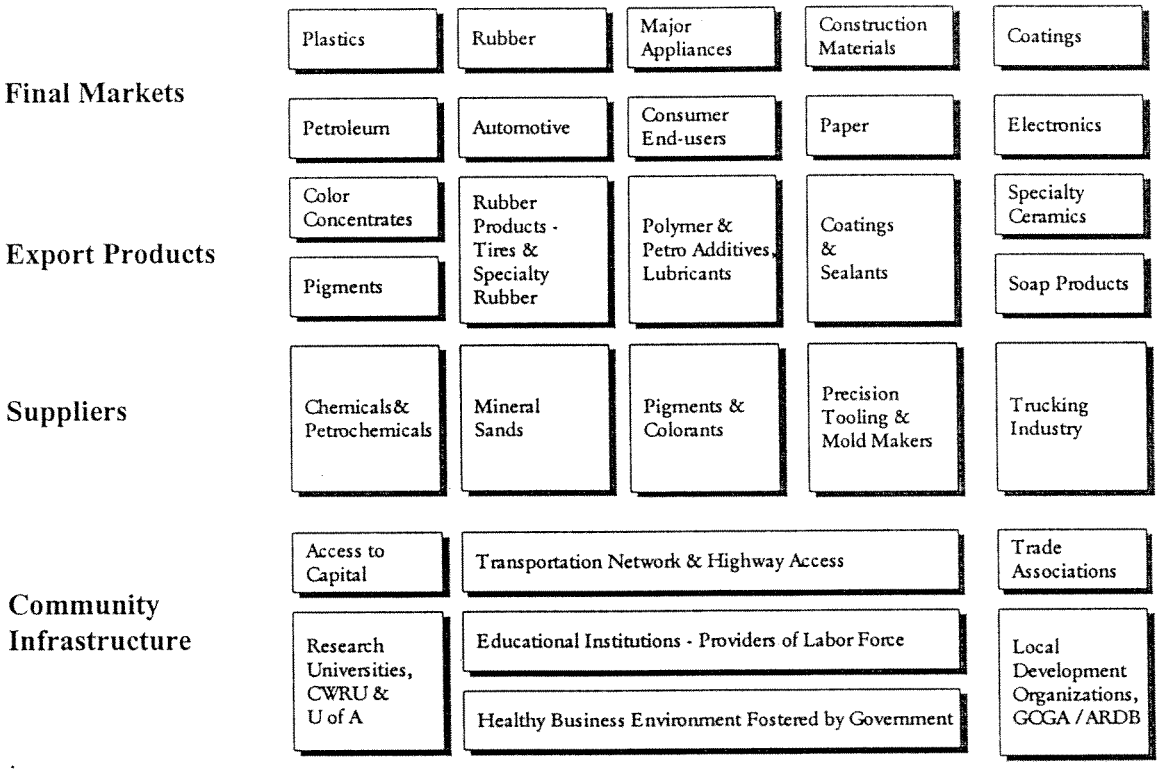
Source: Ohio Bureau of Employment Services, Occupation by Industry Data. Sixty-six percent of the jobs in the cluster are related to production. High-skilled precision production jobs account for 15 percent of employment. Less skilled production occupations provide over 50 percent. Machine setters, at 30 percent of cluster employment, are the largest occupational category. With the exception of clerical workers (12 percent), no other group makes up more than 10 percent of the work force. Management, support occupations, engineers, computer operators, and those in marketing and sales account for 21 percent of cluster employment.

## Cluster Relationships

The chemical cluster in Northeast Ohio is made up of a mature and extremely diverse set of industries. Figure 2 illustrates the structure of the Northeast Ohio chemical cluster. The four components of the cluster are final markets (customers), export products (the core products of the cluster), suppliers, and community infrastructure.

Figure 2

Chemical Cluster Map




### Final Markets

The chemical cluster's customers include almost all manufacturing industries. Major users include the plastics, rubber, coatings, automotive, petroleum, electronics, building and renovation, and paper industries. The paint and coating and sealants sectors' largest customers include both construction and retail sales.

The chemical clusters customers are located worldwide, primarily in the U.S., Europe and the Pacific Rim. Some industries have customers grouped in the Great Lakes Region, especially automotives, major appliances, and plastics.

It is also significant to note that many customers are firms that are within the cluster. For example, the rubber industry is supplied with pigments from the industrial chemicals sector.

## Export Products

Almost all products of the cluster are exported outside the region. Industrial and miscellaneous chemical export products include pigments, polymer additives, and petroleum additives. The paints sector exports decorative paints, coatings, and sealants. Examples of rubber products include tires, rubber components for piping, and sheet tank lining.

## Suppliers

The two major categories of suppliers for the chemical cluster include raw materials, machinery and molds. Raw materials include mineral sands containing titanium or zirconium and chemicals such as chlorine and borax. The rubber and paint industries use petrochemicals. Many raw materials are located at their natural source outside of the U.S., such as from mines in South Africa. Chemical firms either purchase the sands directly from the mines or from an intermediary in the US. The long distance costs of these materials are not a major concern because competitors will face the same costs, as the locations of natural sources are limited. Other more common chemicals, such as chlorine, will have transportation costs as a factor, thus firms must be able to obtain them locally as much as possible. A number of major chemical suppliers, such as DuPont, have warehouse facilities in the area, so chemicals are available locally. This availability has been an important factor for smaller rubber companies. NEO is also important in providing machining such as precision tooling and rubber molds.

## Community Infrastructure

The chemical cluster relies to different degrees on local universities, primarily the University of Akron and Case Western Reserve University, for technical employees and research and development assistance. Smaller companies tend to rely on the universities for research and development assistance. For example, small companies that make relatively unique products rely on university labs and act as a proving ground for experiments. The universities are relied upon by both small and large companies for entry level chemists, engineers, and business school graduates.

Transportation infrastructure is also critical to the cluster. Trucking and highway access is viewed as essential for product transportation, primarily for the smaller companies. The availability of trucking companies is considered excellent in the region. Air transportation for personnel is also considered crucial, primarily for larger firms.

The business climate is also a critical factor for companies in the cluster. NEO's history as a strong location for industry and the increased desire on the part of government to foster business growth are seen as aids in doing business here. The region has been attempting to become more pro-business in its initiatives. Many firms have also been involved with development organizations such as Workers in Northeast Ohio, the Greater Cleveland Growth Association, the Akron Regional Development Board, and the Ashtabula Growth Partnership.

The chemical cluster has a number of different trade associations geared toward the different sectors. The associations deal with issues such as environmental regulation and safety programs.

Finally, the region has strong access to capital, a fact which especially benefits the smaller firms.

## Competing Regions

The chemical cluster competes with regions worldwide. For a number of companies, there is little Northeast Ohio competition. Many of these firms are so specialized that they only have one or two competitors in the world. For example, the titanium dioxide industry is highly capital intensive with closely protected technology and therefore, has considerable barriers to entry. Some firms, such as Ferro, are dominant in their market niche worldwide. In contrast, the paint industry has several major companies in the area, among them Glidden, Sherwin-Williams, and RPM's coatings division. Also, the rubber industry is fiercely competitive in the area, particularly among the many small companies.

# Cluster Evolution

The chemical industry is one of the oldest manufacturing industries in the U S. It makes up more than 10 percent of U.S. manufacturing gross product - more than any other sector - and is one of the largest exporting industries in the U.S.

The chemical industry is characterized by large multinational enterprises and high levels of trade and international investment. Beginning in the late 1800s, the industry developed cartels and split the world into territories. The Gunpowder Trust between DuPont and European firms was an example of these divisions. Innovations in technology, especially in synthetic rubber and plastics, led to exponential growth in the 1940s. The U.S., for example, increased its chemical output by 900 percent between 1947 and 1978.

World chemical output is heavily concentrated in Western Europe, the U.S. and Japan. Approximately three quarters of global production is accounted for by these areas. This distribution has changed very little in the past 25 years. However, since 1970, the US has had a declining share of global production, while both Europe and Japan's share's have risen.

Global trends in the 1980s and 1990s for the industry included a concentration of product lines within firms which divested less profitable operations and merging competing lines. In addition, the acquisition of firms has been used as a tool to gain access to new markets or new technology. The 1990s have been characterized by vigorous cost cutting in most segments, flatter management structures, and spin-offs.

Since the 1950s, the US has had a positive net trade balance for the chemical sector. This trade balance can currently be attributed to a surplus in Asia and a small deficit in Europe. There are 850,000 chemical workers in 12,000 plants located in the US. The US also has the largest market for chemicals in the world, so a healthy domestic market is crucial to growth in the industry.

Ohio is the fifth largest employer of chemical workers. It exports $1.6 billion in chemicals per year and is the fourth highest state in spending on pollution abatement equipment in the chemical industry.

## Local Cluster Evolution

The chemical industry got its start in NEO in the late 1800s and early 1900s. Early advantages for the area included water transportation, available raw materials, and location to markets. Different sectors of NEO's chemical

cluster have evolved in different patterns. The area's strong rubber industry began with Dr. B.F. Goodrich establishing a factory in 1870. After World War II, innovations in synthetic rubber caused strong growth in the area. In comparison, Ferro, founded in 1919, developed its chemical products primarily through acquisitions. It originally made cast iron bathtubs and stoves that were coated with glass. The company eventually specialized in glass coatings and later added chemical products. The paint industry also experienced early development in the area. Glidden was founded in the late 1800s and has continued to lead industry innovations, inventing low solvent latex paint in the 1940s. The location of customer industries, such as automotives and plastics, were also important for the cluster's growth. The current cluster includes a number of small firms that were outgrowths of the original, larger firms. In addition, a number of local companies have been bought by foreign companies.

# II. Cluster Potential

The primary external factors driving the performance of the Northeast Ohio chemical cluster are continued advancements in technology and globalization. A number of local, region-specific factors bear on the performance of the cluster.

## External Factors

- **Globalization strongly affects the cluster.** The chemical industry has been characterized by foreign investment and U.S. investment overseas for a number of years. Many local companies have plants overseas. Therefore, growth of the cluster is affected by foreign economies and demand.

- **Maturing markets trigger a search for new markets.** This search has led to a focus on the Pacific Rim and Asia. Consequently, larger firms plan expansions overseas rather than locally.

- **The world market is becoming extremely competitive for commodities as countries develop chemical industries.** The "Big Three" (US, Western Europe and Japan) still control 75 percent of global production. However, developing countries, primarily in Asia, have been increasing their capacity, especially in the production of commodity chemical products. These areas have lower labor costs, fewer environmental regulations, and often government support. This new productive capacity, which is mainly export oriented, has substantial effects on price levels and profit margins. Thus, there is a growing sensitivity to a more competitive international context and any factors leading to increased costs or inefficiency will hamper growth.

- **Chemical industry economic trends are strongly tied to its end-use markets.** As demand changes, products are substituted and companies must always be looking for new uses for their products. A number of companies in the chemical cluster manufacture limited product lines as their products are intended for specific uses. Technological advances often make a company's main products obsolete. Some firms even face competition from suppliers who learn to process materials themselves and then sell directly to the original company's customers. Maintaining a stock of useful products is a constant struggle for these firms.

- **Chemical products that are commodities in nature, such as inorganics, are influenced strongly by exchange rates.** Markets that deal solely in buying and selling specific products are subject to dollar fluctuations. Many chemicals are sold on world markets much as iron ore or agricultural products are sold.

- **Environmental regulation affects product prices.** Price pressures are partially attributable to environmental costs, as regulations are less stringent in developing countries. Most companies in the cluster expressed some degree of difficulty in complying with regulations that foreign competitors are not forced to deal with.

- **Intellectual property rights violations cause losses in some foreign markets.** The "adoption" of technology by foreign competitors is often cited as a problem in the cluster's industries. Reverse engineering of products also leads to lost sales and the reduction of market share.

## Internal Factors

### Positives

- **Northeastern Ohio (NEO) has competitive wages and a relatively low cost of living.**

- **NEO has a technically skilled labor force.** Local universities, especially the University of Akron and Case Western Reserve University, provide graduates with necessary skills. Specifically, chemists and chemical engineers, engineers and technicians are available. In addition, companies in the metro regions were satisfied with employees at all levels and commended their Midwestern work ethic.

- **The region supports a pro-business climate.** Both Ohio's Governor Voinovich and Cleveland's Mayor White have established a foundation for linking the private and public sectors. Ohio and NEO in particular are beginning to become known as good places to do business, especially if heavy industry is involved.

- **Local universities are available for research and development assistance.** The accessibility of local universities has been an important factor for smaller firms that do not have in house labs. Many companies are aware of industry research programs at both Case Western and the University of Akron, even if they are not involved in any joint projects. The opportunity for increased collaboration between business and the

universities does appear to exist, but many firms do not see a place for such interactions at this time.

- **The diversity of the cluster promotes economic vitality.** Because the cluster serves such a wide range of end markets, it is less susceptible to cyclical conditions.

Negatives

- **Some labor skills are lacking, primarily in high school graduates.** This segment of the labor force lacks basic reading and writing skills and an adequate work ethic. It is important to note that these labor complaints were strongest from firms in non-metropolitan areas, specifically Ravenna and Ashtabula. These firms also cited an inability to attract talent due to their distance from Cleveland or Akron. This led several small firms to discount the possibilities of local expansion.

- **The lack of international flights and hubs at Cleveland Hopkins International Airport is a constraint for global firms.** This was primarily an issue for the larger firms. Smaller firms that utilize domestic flights were satisfied with the facilities.

## Requirements for Cluster Vitality

- **NEO must provide a labor force with basic reading and math skills.**

- **International flights must become available at Cleveland Hopkins International Airport.** This was a strong concern for international companies that are headquartered in the region.

- **A favorable regulatory environment is crucial to the continued success of companies.** Environmental issues at both the national and state levels are of concern to industries within the cluster. Air and water quality, and waste disposal issues are at the top of industry leaders concerns.

- **The region must continue its progress in quality-of-life factors.** Maintaining a high quality of life is necessary both to attract talent that is lacking in the region and to retain firms' world headquarters.

- **The state must develop more pro-active programs to attract business.** The success of the State of North Carolina was cited as an example of how beneficial pro-business activities can be. Most companies commended the work done by local and state government, but stated that more needs to be done.

# III. Opportunities for Collaborative Action

The chemical cluster in Northeast Ohio (NEO) is mature and established. The cluster is essentially made up of eight distinct industries. In addition, firms tend to specialize within those industries. This diversity limits avenues for collaboration. There appears to be little interest in exposing manufacturing processes to the scrutiny of potential competitors. As mentioned earlier, even suppliers often end up taking market share away from their previous customers by developing technologies on their own. Most of the larger firms in the cluster have their own research and development facilities that occasionally enter into joint projects with other companies. Many of the smaller firms are at or near the limits of their production capacity and do not seem to be pressing for increased collaborative efforts at this time.

Common concerns such as environmental regulation are dealt with through trade associations. Some of these issues are very industry specific, while others are common to a great many industries. Most of the companies in the cluster are either satisfied with the representation they receive through such organizations, or feel that it is not a priority. This attitude is evidenced by their lack of engagement with organizations to which they already belong.

Companies in the region interact at a managerial level on topics such as personnel issues. However, many of the large companies handle such matters internally, while smaller firms often use informal networks of management staff to discuss personnel and local management issues. There does not seem to be a demand for new organized channels for addressing such concerns.

The companies interviewed seem to be satisfied with the status quo and feel that current informal relationships are sufficient. They do not appear to be interested in any further collaborative effort, either in matters of products or technology advancement.

# Appendix

The Northeast Ohio region includes the following eight counties: Ashtabula, Cuyahoga, Geauga, Lake, Lorain, Medina, Summit, and Portage.

Cluster Definition by Standard Industrial Classification (SIC) code:

| SIC | Description |
|---|---|
| 147 | Chemical and Fertilizer Minerals |
| 281 | Industrial Chemicals |
| 284 | Soap, Cleaners and Toilet Goods |
| 285 | Paints and Allied Products |
| 289 | Miscellaneous Chemical Products |
| 301 | Tires and Inner Tubes |
| 306 | Fabricated Rubber Products, N.E.C |
| 329 | Miscellaneous Nonmetallic Mineral Products |

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**Other sources of information:**

Annual reports of local chemical companies

Information from Web Pages of local chemical companies

Crain's Cleveland Business, numerous articles on local chemical companies